Center Independent Research & Development: JPL IRAD

Rad-Tolerant Low Power Avionics for Deep Space Small Spacecraft

Completed Technology Project (2015 - 2018)

Project Introduction

This effort is focused on the development a low power, low mass and radiation tolerant integrated avionics platform for small spacecraft applications including: orbiters, landers, and deployables/daughtercraft. This avionics will demonstrate multiple subsystems in a spacecraft integrated into a single assembly sharing an embedded multicore processor which is 8x faster then the current flight processor. The assembly will integrate Command and Data Handling (CDH), telecom, Guidence Navigation & Control (GNC), Motor Control, and Power. This is a fully rad-hard platform.

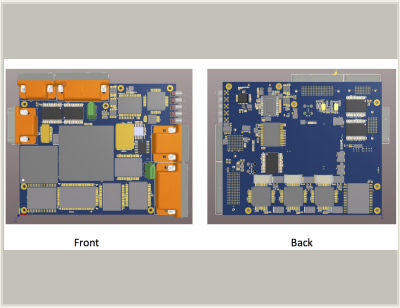
Small Spacecraft Avionics (SSA) is an avionics platform designed to fill the gap between cubesats and large flight avionics. The avionics is designed to operate in dual or single string configuration. SSA integrates CDH, GNC, motor control, and telecom into a single assembly. SSA supports SpaceWire interconnects to the payloads as weill as PMBus interface to the power subsystem. SSA provides an integrated avionics solution in a small form factor to allow missions to perform deep-space flagship-quality science in a small spacecraft and reduce cost and schedule. SSA is designed to enable low-cost small spacecraft by providing a commidity avionics solution which can support a variety of missions out of the box.

Anticipated Benefits

SSA presents lower cost, power, mass, volume. Advantages compared to RAD750 based large spacecraft C&DH systems are: a) 8X CPU performance, b) 20X throughput capability, C) 5X lower mass, d) 6X lower power. Benefits of integrated avionics platform compared cube sat C&DH systems are: a) higher radiation capability, b) longer life capability and c) higher reliability, and d) capability to support flagship-class instruments. Other benefits include: enabling less complex spacecraft with less S/C mass spent on cabling, simplicy enables more responsive/nimble application to unique mission needs. A more commodity-oriented platform enabling low-recurring-cost, more reuse, and industry sourcing of hardware.

SSA will offer a rad-tolerant solution for deep-space missions which can be deployed at much lower cost, power, mass, volume than current industry state-of-practice. This will enable small companies and universities to enter space without haveing to trade the risk posture of cubesats against the unaffordability of large hieratige avionics platforms.

This platform offers the same benefits of improved SWAP and Cost to other govenment agency's missions as it does for NASA missions: lower cost, power, mass, volume. It also has these advantages compared to RAD750 based large spacecraft C&DH systems as well as compared to cube sat C&DH systems. Other benefits include: enabling less complex spacecraft with less S/C mass spent on cabling, simplicy enables more responsive/nimble application to unique mission needs. A more commodity-oriented platform enabling



Small Spacecraft Avionics Flight Processor Card (front/back)

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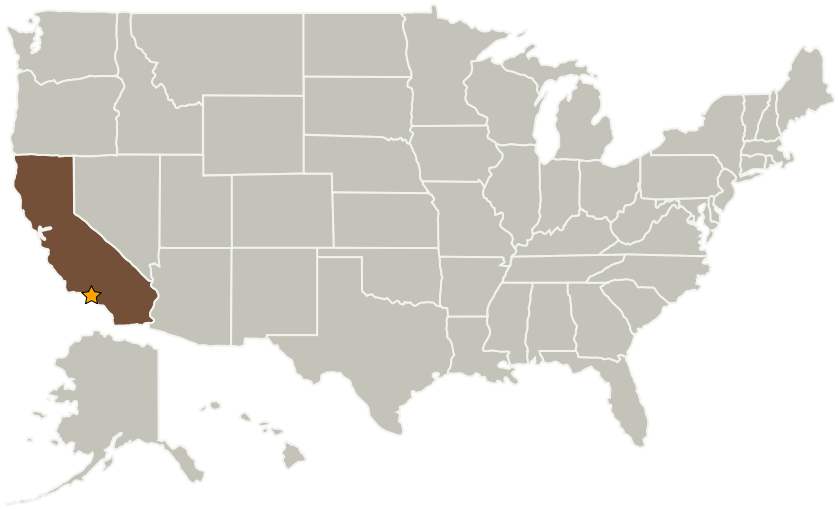
low-recurring-cost, more reuse, and industry sourcing of hardware.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California

Co-Funding Partners	Type	Location
Sierra Lobo Inc.	Industry Small Disadvantaged Business (SDB)	

Primary U.S. Work Locations
California

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Center Independent Research & Development: JPL IRAD

Project Management

Program Manager:

Fred Y Hadaegh

Project Manager:

Fred Y Hadaegh

Principal Investigator:

William D Whitaker

Co-Investigators:

Courtney B Duncan
John Y Lai
Frederick Serricchio

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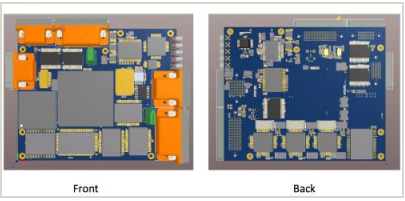
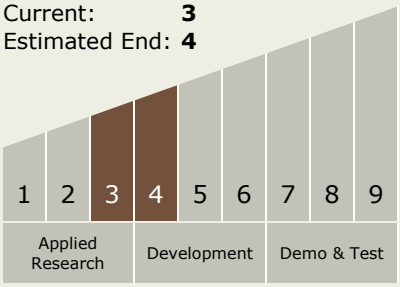
Images



JPL_IRAD_Activities Project Image
Small Spacecraft Avionics Flight Processor Card (front/back)
(https://techport.nasa.gov/image/28036)

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.2 Avionics Systems and Subsystems
    - TX02.2.4 Low Power Embedded Computer Systems

Target Destinations

The Moon, Others Inside the Solar System

Supported Mission Type

Push